

August 18.—Comet nearly eclipsed by moonlight, though could be traced as well spread out, with central portion fairly condensed. Colour very pale bluish white.

August 24.—Early evening, dark. Comet well seen in finder. In $9\frac{1}{4}$ -inch reflector nucleus globular in form, and well condensed, of pale white colour, about 2' in diameter, and surrounded by wide but very rare coma. A broad, though extremely faint, tail, could be traced to about 16'.

Spectroscope gave dim continuous spectrum, with brighter concentration in one portion, but no bands detected.

August 25.—Comet well seen on dark background. Cometic envelopes, though faint, well defined, with two dark intervals in preceding portion, fairly conspicuous condensed nucleus, with dark rift behind, and broad, faint tail about 16' in length. No bands detectable with spectroscope.

August 28.—Comet already much fainter. Detail not well seen, but considerable surrounding coma still visible. Stellar point in condensed portion suspected. Comet subsequently observed on August 29, 31, September 1, 2, 5, 7; but no great changes detectable, only getting gradually fainter, though condensed nucleus and wide spread surrounding coma in hyperbolic form still noticeable; dark rift in faint tail generally seen, coma usually showed a very streaky appearance.

Approximate Positions.

	C. U. T.		R. A.		S. Dec.			C. U. T.		R. A.		S. Dec.	
	h	m	h	m	°	'		h	m	h	m	°	'
Aug. 15	11	0	21	12	31	4	Aug. 29	8	0	21	29	35	0
17	10	0	21	13 $\frac{1}{2}$	31	33	31	8	0	21	31 $\frac{3}{4}$	35	16
18	10	0	21	14 $\frac{1}{2}$	32	12	Sept. 1	8	0	21	33	35	24
24	10	0	21	22 $\frac{1}{2}$	33	54	2	9	30	21	34 $\frac{1}{2}$	35	32
25	9	15	21	23 $\frac{3}{4}$	34	21	5	8	30	21	38 $\frac{1}{2}$	35	49
28	8	30	21	27 $\frac{1}{2}$	34	51	7	8	15	21	40	36	0

Grahamstown :
Sept. 9, 1899.

Observations of Jupiter in 1899. By W. F. Denning.

Between 1899 February and September (but chiefly in the months June to September) I obtained 668 transit times of various markings on *Jupiter*. All the observations were effected by the help of a 10-inch With-Browning reflector and one of Steinheil's monocentric oculars having a power of 312. It is not intended to give the details of the observations,* but simply

* This is rendered unnecessary by the fact that Mr. A. S. Williams of West Brighton is investigating the motion of the equatorial current, while the Rev. T. E. R. Phillips, of Yeovil, is discussing all the observations of spots in the extra-equatorial currents.

a condensed summary of the principal results, as they may be useful in this form to compare with my similar results for 1898 (*Monthly Notices*, lviii. p. 480 *et seq.*).

Equatorial Spots.—Twenty-seven white and dark spots situated on the N. edge of the great S. equatorial belt gave a mean period of

$$9^{\text{h}} 50^{\text{m}} 24^{\text{s}}.6.$$

This is one second greater than the rate derived from 23 similar markings observed here in 1898, so that the equatorial current (or at any rate that section of it contiguous to the S. belt) has slightly moderated its velocity during the last twelve months. There were large differences (as in 1898) in the periods found from the individual spots in this latitude. The maximum period was $9^{\text{h}} 50^{\text{m}} 35^{\text{s}}$, the minimum $9^{\text{h}} 50^{\text{m}} 18^{\text{s}}$. The average number of observations of each of the spots was 11, and the number of rotations 255.

North Tropical Spots.—Sixteen white and dark spots on the north side of the northern equatorial belt indicated a mean period of

$$9^{\text{h}} 55^{\text{m}} 28^{\text{s}}.8;$$

but in this latitude also the various objects gave very discordant rates. Three of them moved with remarkable swiftness, and had a mean period of $9^{\text{h}} 55^{\text{m}} 16^{\text{s}}.4$, while 13 others gave $9^{\text{h}} 55^{\text{m}} 32^{\text{s}}.5$. The average number of observations for each marking was 7, and the rotations performed 153. In 1898, three dark spots in this current gave a period of $9^{\text{h}} 55^{\text{m}} 26^{\text{s}}.3$.

Markings in Southern Hemisphere.—Three spots in latitude about 25° to 30° S. had a mean period of

$$9^{\text{h}} 55^{\text{m}} 18^{\text{s}}.6.$$

Two other objects further south, in about lat. 40° to 50° S., moved more rapidly, the rate being

$$9^{\text{h}} 55^{\text{m}} 9^{\text{s}}.2.$$

Markings in Northern Hemisphere.—Two well-defined dark spots were watched in lat. 25° to 30° N., and they exhibited a considerable difference of motion. One, which was nearly in the same longitude as the red spot in 1899 March, indicated a period of

$$9^{\text{h}} 55^{\text{m}} 29^{\text{s}}.8.$$

The other moved more slowly than any other object on the disc of the planet, its rate being

$$9^{\text{h}} 55^{\text{m}} 53^{\text{s}}.5.$$

The Red Spot and Hollow in the S. Hemisphere.—The spot continued exceedingly faint in 1899, but on a night of good definition its complete elliptical outline could be distinctly perceived except perhaps its extreme southern side, where it appeared to blend with the dusky south temperate belt. The *f* end of the spot was more distinct than the *p* end, and this has been the common experience in recent years. The hollow in the great southern equatorial belt seems to follow the spot by 2 or 3 minutes; but this appearance is due to a difference in the form of the shoulders of the hollow. The *p* side is flatter than the *f* side, hence the spot seems naturally to lean towards the latter. As the hollow in the belt is a very conspicuous feature and exhibits precisely the same rotation period as the red spot, and as the latter is often partly or wholly obliterated in bad definition, I obtained transits of the centre of the former object as the times may be regarded as practically identical with the times of central transit of the red spot. Between February and September 35 transits were taken, and the first and last of these, as under, appear to accurately represent the position of the object on the two dates :—

		h m		λ °
1899 February	2	18	39	29.5
September	16	5	41	36.5

545 rotations were performed in this interval, and the mean period was

$$9^{\text{h}} 55^{\text{m}} 41^{\text{s}}.9.$$

This is one-tenth of a second in excess of that deduced from my observations between 1898 March and July. But there is no doubt that, after 1898 July, the spot exhibited a marked acceleration of motion, and it was unfortunate that, during the autumnal months, *Jupiter* was too near to the Sun to permit of the continued observation of this feature. In 1899 February, when the planet came favourably into view, the hollow arrived on the central meridian fully 5 minutes before its computed time. In fact the rotation period of the object varied as follows :—

		h	m	s
1898 March to July	...	9	55	41.8
1898 August to 1899 April		9	55	41.2
1899 May to September	...	9	55	42.0

That this change of rate actually occurred is beyond question, for it is well corroborated by the evidence of other observers.

Summarising my results for 1899, the figures are :—

Objects.		Rotation Period.		
		h	m	s
27	White and dark equatorial spots ...	9	50	24.6
16	North tropical spots lat. 12° – 15° N.	9	55	28.8
3	Spots in S. hemisphere lat. 25° – 30° S.	9	55	18.6
2	„ „ lat. 40° – 50° S.	9	55	9.2
1	„ N. „ lat. 25° – 30° N.	9	55	29.8
1	„ „ „ „	9	55	53.5
	Red-spot-hollow in S. hemisphere ...	9	55	41.9

Bristol: 1899 September 21.

Early History of the Great Red Spot on Jupiter.

By W. F. Denning.

In the Supplementary Number of the *Monthly Notices*, 1898, I gave some particulars of observations of objects apparently identical with the great red spot on *Jupiter*, as their positions and rate of motion were found consistent with one another. The varying period of rotation was traced back to Gledhill's first accurate recognition of the ellipse on 1869 November 14. Since this paper was published I have collected many additional observations and drawings of the hollow in the great southern equatorial belt, or of the ellipse, extending back to 1831 September 5. Though the red spot or its modification, the ellipse, appears to be quite wanting from many of the drawings, yet a very well marked hollow in the south equatorial belt may be safely presumed to accurately indicate its position, as it has done in several recent years. Before 1857 the oval spot appears to have been indistinguishable, and was probably covered with material outlying it above the surface of *Jupiter*. The Rev. W. R. Dawes in 1857 figured an object similar to it in *Monthly Notices*, vol. xviii. p. 50, and Sir William Huggins has sent me his drawings (very excellent copies of which were kindly made for this purpose by Lady Huggins) from 1858 December to 1860 April, and in many of these a well-defined ellipse with dark ends is shown in the south hemisphere. I am also much indebted to Mr. A. Stanley Williams and to Mr. W. H. Wesley for copies of many of Schwabe's drawings of *Jupiter* between 1831 and 1856. These were taken from the MS. volumes of Schwabe's observations in the possession of the R.A.S. Mr. J. Baxendell, of Southport, has also sent me some copies of papers published by his father, the late Joseph Baxendell, F.R.A.S., which contain some well-executed delineations of the hollow in the south equatorial belt (see *Monthly Notices*, vol. xx. p. 244). In the *Memoirs of the*